

# INFLUENCE OF FERTILIZATION ON NITROGEN AND POTASSIUM CONTENT IN LEAVES AND QUALITATIVE INDICES OF APPLE FRUITS

## INFLUENȚA FERTILIZĂRII ASUPRA CONȚINUTULUI DE AZOT ȘI POTASIU DIN FRUNZE PRECUM ȘI ASUPRA UNOR INDICI CALITATIVI LA FRUCTELE DE MĂR

*BOLOHAN Diana Elena<sup>1</sup>, VOLF Mariana<sup>1</sup>, ANGHEL Roxana<sup>1</sup>*  
e-mail: bolohandiana@yahoo.com

**Abstract.** *Fruit quality is influenced by climate factors, biological factors and applied agrotechnics - fertilization is an important part of crop technology. Two indices that participate together in achieving the main fruits organoleptic characteristics are soluble solids ( $^{\circ}$ Bx) and titratable acidity (g malic acid /100g acid product). Variants were fertilized with mineral fertilizer (NPK 15.15.15) and foliar fertilizer (Cropmax and Pentakeep-G), applied in various doses. Nitrogen (Nt) and potassium (Kt) content of leaves were positively influenced by the doses of fertilizer. It has noticed that the variants fertilized with a larger amount of potassium led to changes of fruits titratable acidity (TA) values. There were also variations of soluble solids content (SSC). The values of qualitative parameters are different due to the fertilizer type applied in different doses.*

**Key words:** apple, titratable acidity, soluble solids, fertilization

**Rezumat.** *Calitatea fructelor este influențată de factorii climatici, biologici dar și de agrotehnica aplicată – fertilizarea fiind o verigă importantă a tehnologiei de cultură. Doi indici ce participă împreună la realizarea principalelor caracteristici organoleptice ale fructelor sunt: substanța uscată solubilă ( $^{\circ}$ Bx) și aciditatea titrabilă (g acid malic/100g produs). Variantele au fost fertilizate cu îngrășământ mineral (NPK 15.15.15) și îngrășământ foliar (Cropmax and Pentakeep-G) în diferite doze. Conținutul de azot (Nt) și potasiu (Kt) din frunze a fost influențat pozitiv de dozele de îngrășământ aplicate. S-a observat că la variantele fertilizate cu o cantitate mai mare de potasiu au dus la modificarea acidității titrabile (TA) din mere. De asemenea, s-au înregistrat de asemenea variații semnificative ale conținutului de substanță uscată solubilă (SSC). Valorile acestor parametri calitativi sunt diferite și datorită sortimentului de îngrășământ aplicat, în diferite doze.*

**Cuvinte cheie:** măr, aciditate titrabilă, substanță uscată solubilă, fertilizare

### INTRODUCTION

Harvest maturity is determined by some qualitative indices such as flesh firmness, skin color, flesh color, sugar content, and dry substance, total acids content. It is known that fruit quality is positively influenced by right ratios of nutrients supply. Nutrients are involved in accumulation of sugar and water.

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<sup>1</sup> University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

Nitrogen contributes in particular to increase fruit size. High nitrogen content in soil determine fruit firmness decrease, reduces sugar content and vitamins; and increased organic acids (Nomeda et al., 2006).

Potassium increases fruit firmness, sugar content and coloration intensity. High concentrations of potassium in fruits increases fruit acidity, which change report has sugar/organic acid and ultimately change their taste in order to increase flavor. Potassium presence facilitates the water entering into cells, by increasing its protoplasm capacity retention.

In a study regarding nitrogen fertilization, Raese and Drake determined that the highest fruit quality was achieved with the lowest rate of nitrogen and fruit quality was negatively related to nitrogen. (Raese and Drake, 1997). William and Billingsley (1974) found that high amount of N applied to Golden Delicious apple trees increased the amount of green coloured fruit and decreased fruit quality. TA in fruits increased as a consequence of potassium fertilisation rate, especially for trees featuring a low supply condition (William and Billingsley, 1974, Nielsen et al., 1998).

## **MATERIAL AND METHODS**

Researches were carried out in Vasile Adamachi Farm, Iassy county, in 2010. This study was conducted over one crop Idared variety apple trees, in a 4x4m spacing. Fertilizing treatments were randomised within one block; groups of three trees; in three replications. In the experience were studied 9 variants of fertilization with mineral and foliar fertilizers, including the blank:

- V1 – blank;
- V2 – mineral fertilization - N60:P60:K60 (15:15:15);
- V3 - mineral fertilization - N90:P90:K90 (15:15:15);
- V4 - foliar fertilization - Pentakeep - G;
- V5 – foliar fertilization - Cropmax ;
- V6 - mineral fertilization N60P60K60 + Pentakeep-G;
- V7 - mineral fertilization N90P90K90 + Pentakeep-G;
- V8- mineral fertilization N60P60K60 + Cropmax ;
- V9– mineral fertilization N90P90K90 + Cropmax;

NPK 15.15.15 was applied 1/3 in autumn and 2/3 in early spring. Foliar fertilizers (Cropmax and Pentakeep-G) were applied three times, starting when the fruit was 5 mm in diameter, and every two weeks after.

Following the fertilization was determined in the leaves, total nitrogen content through the Kjeldahl method and total potassium content by flam-photometry method.

Fruits were harvested at commercial harvest from each fertilized group of trees.

Quality factors were determined immediatly:

- soluble solids content (SSC) in juice sample obtained from a cross sectional slice was determined with a hand refractometer, expressed as °Brix;
- titratable acidity (TA) from juice samples was determined by titrating with 0.1 N, NaOH, and was expressed as g malic acid/100g fruit.

## **RESULTS AND DISCUSSIONS**

All treatments applied in the orchard had positive influence on total nitrogen content and total potassium content in leaves. Treatments applied to soil (V2, V3) were equally to the Nt content, 2.22%; regarding potassium content

there was a slight increase directly proportional to the doses of NPK 15.15.15. Foliar treatments induced a small increase of accumulation of these macronutrients.

Table 1

Fertilization variants		Macronutrients	
		Nt % leaves content	Kt % leaves content
V 1	control	1.93	0.95
V 2	N60:P60:K60	2.22	1.16
V 3	N90:P90:K90	2.22	1.22
V 4	Pentakeep – G	2.14	1.01
V 5	Cropmax	2.08	1.06
V 6	N60P60K60 + Pentakeep-G	2.13	1.04
V 7	N90P90K90 + Pentakeep-G	2.21	1.10
V 8	N60P60K60 + CropmaX	2.26	1.02
V 9	N90P90K90 + Cropmax	2.29	1.21

Regarding the combined application of mineral fertilizers and foliar (Table 1):

- V8 and V9 recorded the highest values of Nt (%), so we can say that application of mineral fertilizer and Cropmax had the greatest positive influence;
- Pentakeep-G fertilizer in combination with mineral fertilizer increased with 10% Nt leaf for V6 treatment and 14.5% Nt for V7 treatment than controls (V1), the increase was directly proportional to the dose of mineral fertilizer;
- small doses of mineral fertilizer do not influence too much the increase of Kt in leaves, high doses has a more significant influence;
- Cropmax in combination with mineral fertilizer had a greater efficacy compared to Pentakeep-G.

Table 2

Fertilization variants		Qualitative indicators		
		SSC (° Bx)	TA (malic acid/100 g fruit)	Ratio Sugar/TA
V 1	control	10.97	0.319	25.04
V 2	N60:P60:K60	10.87	0.343	23.04
V 3	N90:P90:K90	11.07	0.405	19.91
V 4	Pentakeep - G	10.83	0.392	20.10
V 5	Cropmax	10.47	0.380	20.05
V 6	N60P60K60 + Pentakeep-G	11.00	0.417	19.21
V 7	N90P90K90 + Pentakeep-G	10.67	0.392	19.79
V 8	N60P60K60 + Cropmax	10.93	0.380	20.94
V 9	N90P90K90 + Cropmax	11.10	0.441	18.31

Following the fertilization there was a significant increase of the leaf total nitrogen content 7-18% Nt, while the soluble solids content decreased by a maximum of 4.6%. Except V3, V6 and V9, there was a slight increase of this production quality indicator. In contrast, foliar treatment with Cropmax (V5) had a negative influence, preventing the accumulation of sugars.

All variants of fertilization increased titratable acidity in fruit, at a rate of 7.5 - 38.2%. N90 P90 K90 in combination with foliar fertilizers applied led to the significant increases in apple fruit acidity. The maximum was recorded for V9 variant (*Table 2*).

There was a very strong correlation between the sugar/acid ratio and nitrogen and potassium leaves content. According to the literature, value of this ratio for Idared variety is 18.7 for a balanced taste, value retrieved in V9.

## CONCLUSIONS

1. Compared with the sample from control variant, all other fertilizers have increased the value of total potassium content in leaves, up to 1.22% Kt.
2. Soluble solids content was slightly decreased in most variants of fertilization.
3. V9 has led to the largest increases of the values for all parameters included in the study, both in the leaves and apple fruits.
4. High concentrations of nitrogen and potassium increased fruit acidity, which has change ratio sugar / organic acid, increasing values for this indicator.

## REFERENCES

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